SCIENCE

FRIDAY, DECEMBER 23, 1887.

A MOST INTERESTING CELEBRATION took place in Philadelphia on Dec. 12. The occasion was the one-hundredth anniversary of the birth of Thomas Hopkins Gallaudet, the pioneer of the movement for the instruction of the deaf in this country. A short biographical sketch of Gallaudet was read, and one of his poems was recited by four deaf girls in the sign-language. The address of the evening was delivered by Prof. A. Graham Bell of telephone fame, and well known for his researches into the heredity of deaf-mutism. Professor Bell gave an interesting history of the knowledge of deaf-mutism, pointing out how completely its nature was misunderstood until within very recent times. Not two centuries ago the legal status of a deaf-mute was like that of an idiot. The notion of his being capable of receiving education was ridiculed, and the only attempts to make them speak was by a church miracle. Three names in the eighteenth century stand out as the successful teachers of the deaf, — Heimcke, De l'Epée, and Braidwood. Gallaudet became interested in the deaf-mute by meeting the young daughter of his neighbor at Hartford, Dr. Cogswell. He succeeded in teaching her a little; and when, later, it was found out how many more were similarly afflicted, a meeting was called at Dr. Cogswell's house, and it was decided to send young Gallaudet to England to learn the methods of teaching, and introduce them into America. He arrived in England, and found that Braidwood had bound all his teachers under a heavy fine not to reveal his methods to any one. It was a money-making institution, and after long delays he saw that it was hopeless to stay in England. He then fortunately met the Abbé De l'Epée, who welcomed him to France with open arms, taught him all he had to teach, and sent with him one of his most talented pupils, Laurence Clerc, to spread the great gift to America. On their arrival they founded the institution at Hartford, which soon gave rise to others all over the land. The perseverance and self-sacrifice of Gallaudet were the means of bringing a life worth living to thousands of the deaf of America. The address was interpreted into the sign-language as rapidly as it was spoken, and was greatly appreciated by the many deaf persons in the audience. The two sons of Gallaudet, both of whom are engaged in continuing the work of their father, — one as the president of the deaf-mute college at Washington, the other as a pastor for the deaf, — were present, and made remarks suitable to the occasion.

THE DEATH HAS BEEN ANNOUNCED of Gustav Theodor Fechner, professor of experimental physics at the University of Leipzig. Fechner has been before the scientific world in many fields of activity, and for many years. He began his career as a physicist, and for many years devoted himself to experimental work, and edited a physical journal. But the chief work of his life was begun when nearly sixty years old. This was the work on psychophysics, — a field hitherto touched upon in only the most meagre way, and owing its scientific recognition as well as its systematic development to him. He here announced the psychophysic law, stating the relation between the intensity of the stimulus and that of the resulting sensation, and verified it with a large number of ingenious and laborious experiments. Around this central conception of Fechner's has sprung up a large literature, in part criticising his fundamental points, in part developing and adding to his work and his methods. Whatever the final outcome of the movement, it will always owe its vitality and its scientific development to Fechner. This interest was maintained by Fechner until his death. Two more books on psychophysics appeared from his pen, and a large number of articles, the last of which were written only a few years ago. Fechner's mind was characterized by two streams of interest; the one leading him to exact science, the other to a somewhat imaginative speculation. He was deeply impressed with the poetic, the mystic side of nature, and struggled to make the world seem rational without losing any thing of grandeur or mystery. These two streams of thought come nearest to meeting in the second part of his psychophysics, but it is greatly to his credit that he succeeded so well in keeping science and speculation apart. Only once did he seriously confound the two, and that was in the somewhat subordinate part he played in 'the fourth-dimension experiments' of Zöllner. Besides his scientific works and his speculative ones, he was the author of a book of poems and a book of riddles. He died at the advanced age of eighty-six. He had been troubled for many years by a double cataract, and was prevented from doing much work by this disease.

THE WOMAN'S TEMPERANCE PUBLICATION ASSOCIATION of Chicago has just issued a little book by William T. Hornaday, entitled 'Free Rum on the Congo.' This book is an earnest appeal to Americans for the suppression of the liquor traffic in Africa, especially in the Kongo basin. As might be expected, the author ascribes the destructive influence of European civilization upon the natives of all countries almost solely to the influence of alcohol, and overlooks other important agents which nobody, however deep his sympathy with the unfortunate victims of European civilization may be, can remedy. The physical destruction of uncivilized races is brought about by diseases introduced by Europeans, among which alcoholism takes its place, although not by any means the most prominent one. But the mental deterioration of the natives is not less important. The cheap products of European manufacture, which are in every respect superior to those of native manufacture, make the native arts and industries decline rapidly, and vanish within a few years. As nothing new is given to the natives in place of their lost arts, their lost culture, they sink to a far lower stage than they occupied before the advent of the whites. It is at this moment that the missionary generally makes his appearance. It is only in rare instances that he succeeds in raising the natives to a higher standard. Generally the Christianity he introduces is nothing else than a new fetich instead of the old one. He is taught that agriculture is the only means of civilizing a nation, and applies this theory regardless of the character of his pupils and without effect. Thus the native falls into a state in which he requires European products, and has little to offer in exchange. He is not accustomed to work hard and steadily, and therefore the sole effect of his contact with the white man is the promotion of his laziness and of all his bad propensities. In these two facts lies the root of the destruction of uncivilized peoples. Alcoholism is only a small part of the evil influences threatening the natives, and the suppression of the liquor traffic will not go far to improve their condition. It is well known that the negroes throughout Africa, with the exception of a few tribes, were acquainted with alcoholic drinks before the advent of the whites. The Kaffres, the Balunda, the Waganda, brew beer and make palm-wine, which they drink in excessive quantities. But rum and gin are more dangerous, as they contain more alcohol; and a law prohibiting their importation would be a gain for the natives. But the Woman's Temperance Association, in endeavoring

to arouse an interest in the suppression of alcohol traffic in Africa, ought to know, that, even if its aims were reached, the negroes would be little better off. There is only one way to improve their state: it is to develop their arts and industries; to improve the methods of agriculture where such is practised, to further stock raising and trading where the negroes are stock raisers and traders. After this has been done, the missionary may be able to Christianize his pupils. The intelligent missionaries, who understand that an improvement of the material welfare of the natives must precede any teaching of religion, are not many. The author, whose aims are very praiseworthy, has not grasped the question of education of the natives He overestimates one cause of their ruin, and underestimates their faculties. The spread of Mohammedanism shows that the native is well able to protect himself from alcohol, if his other energies are not destroyed by foreign influence. This shows that the principal problem is not the prohibition of alcohol, which of course is the chief aim of the Woman's Temperance Association, but the stimulation of the energies, and development of the faculties, of the natives.

THE GERMAN SYSTEM OF NORMAL SCHOOLS.[1]

IN Germany schools have a social as well as an educational rank. They may in general be divided into lower, middle, and higher schools. The tuition, which is common to all, is graded, so that the poorer and lower social classes are driven into the lowest grade of schools. These are called *Volks*, or people's schools. In Prussia ninety-one per cent of all children attend them; in Bavaria, ninety-six per cent. Their course of study is rounded up and complete in itself. This school leads into no higher school. The length of its course of study is eight years, — from the age of six to that of fourteen. It is for this grade of schools that the German normal schools prepare, and have always prepared, teachers. The higher schools are taught by classically trained university men, even in the elementary grades.

German normal schools arose in the middle of the eighteenth century, and were established and maintained almost wholly from philanthropic motives. They educated pious young people for a business to which was attached neither competence nor worldly honor. Externally their growth was greatly stimulated by the rise of that great democratic wave which has swept through the world during the present century; furthermore, by that fear of an uneducated proletariat which arose with the French revolution; and, finally, by that high patriotism which saw in the education of the German people the hope of freeing Germany from the domination of Napoleon. Internally the normal schools received a new birth through the educational revival which arose with Rousseau and Pestalozzi.

But at the close of the Napoleonic wars, Germany relapsed into the old police state, and soon suffered the internal contradiction of a free intellectual development of the people in its schools, and the cast-iron rigidity of a bureaucratic and despotic system of government. This contradiction culminated in the revolution of 1848. A re-action followed, and the normal schools, which had grown numerous, were accused of being the main disseminators of revolutionary ideas. In 1854 there followed the three famous Prussian Regulations, which eliminated from the normal schools the spirit of Pestalozzi and modern development, and reduced them to medieval handmaids of the Church and a bureaucratic State. Other German powers followed the example of Prussia. Authority took the place of self-activity in the schoolroom, and German education sank from its high estate. This was the condition of education in Germany until the great day of German unity, which came at the close of the Franco-Prussian war. The oppressive Regulations were repealed, the spirit of progress and free development of mind returned, and Germany resumed her former place as the leader of educational advancement. The number of normal schools increased, until there were enough to supply all teachers needed for the people's schools. The number in 1882 in Prussia was one hundred and eleven, nine of which were for women, the rest for men, there being no co-education in German normal schools. Each school has a director, a head teacher, four ordinary teachers, and one assistant. It is attended by about a hundred students, about two-thirds of whom board in the school. The board is very cheap, not exceeding a dollar a week. The State pays the deficit, if one occurs. I apprehend that the main reason for this close connection with the school is to be found in the tendency of the normal students to imitate the excessive beer-drinking and carousing so common among the students of the university. The employment of women as teachers in Germany is yet regarded as an experiment in many parts of the country, and occurs usually only in graded girls' schools. Director Leutz of Karlsruhe said to me, "So far, they give good satisfaction, for they are still young and fresh, but who knows what they will become when they get old and cross?"

The fact that Germany can supply all its *Volks* schools with graduate teachers from the normal schools, finds its explanation in these facts: 1. All students take a continuous course, and all graduate, as indeed they must before they can become teachers; 2. Nearly all graduates remain teachers, for a German rarely becomes that for which he was not specially educated; 3. Teaching is a profession in Germany, since none but trained persons are allowed permanently to teach in that country. The teacher is a civil officer, and holds his position with a life-tenure. I find by computation that the average length of service of Prussian teachers for the last fifty years is sixteen and nine-tenths years; so that, aside from the increase in the number of schools, but five and nine-tenths per cent of the whole number of teachers must be renewed yearly. Director Rein of Eisenach, in Sachen-Weimar, and Director Leutz of Karlsruhe, in Baden, both assured me that not more than five per cent of the number of teachers in those states is renewed yearly. This makes it possible, with a reasonable number of normal schools, perhaps one for each hundred thousand inhabitants, to supply trained teachers for all schools. Every year, however, in Illinois, over twenty per cent of all teachers are beginners. At this rate, to supply our Illinois schools with trained teachers, it would take one hundred and forty-two normal schools, each having one hundred students, a three-years' course, and graduating thirty-three students annually. We have, in reality, two normal schools, which graduate from twenty-five to forty students each year.

German normal schools are administered by the state educational minister or commissioner, a provincial school commission, and by the director.

The same difficulties which have beset us, concerning the proper preparation of candidates for the normal schools, exist in Germany. Most of their candidates come naturally from the *Volks* or people's schools; but, as we have seen, their course of study is strictly elementary, and closes when the student is at the age of fourteen. The common rule is to require three years of preparation before entering the normal school. This preparation is obtained in any one of three ways: 1. Privately (this happens in villages where only the *Volks* school is found); 2. In the advanced grades of middle and higher schools; 3. In special preparatory schools. Of this kind, Prussia has thirty, whereas each normal school of Saxony has its own preparatory school. The pupils are here taken at fourteen direct from the *Volks* school, and graduated six years later. The course of study in the preparatory schools is purely academic, and consists of (1) religion, (2) German (reading, grammar, etc.), (3) mathematics (arithmetic, algebra, geometry), (4) history, (5) geography, (6) natural science, (7) writing, (8) drawing, (9) singing, (10) violin, (11) piano, (12) harmony, (13) gymnastics.

That every normal school must have a model and training school has long since been established by law in Germany, and is no longer a question of debate. As the late Director Kehr, of the Halberstadt Normal School, said, "a normal school without a training-school would be like a swimming-school without water." The only feature to which I wish to call your attention is the fact that in Prussia each training-school has a country or district schoo department, i.e., a model of a school taught by one teacher, so that the students have a complete picture of a village ungraded school. I do not dwell upon the subject of the training-school, for I believe that this country has now become pretty thoroughly converted to the idea that the training-school is a necessary part of any thoroughly equipped normal school. Some of you will remember, how-

[1] Read at the National Teachers' Association, in Chicago, July, 1887.

ever, in the discussion of my paper on model schools, at Saratoga, in 1883, that one of your members indulged in a prophecy concerning a gentleman who was advocating the need of training-schools in New England normal schools, to the effect, that, if the gentleman lived five years longer, he would not know so much about the subject as he did then. Only four of the years set by the prophecy are past; but, if that gentleman has even begun to know less on this topic than he did then, he can tell us to-day, for, by a coincidence, he is to discuss this paper also. I may remark in passing, that the training work takes place during the second and third years of the course, and consists of, observation, 60 hours; model lessons by the faculty, 120 hours; trial lessons by the pupils, 80 hours; special preparation for teaching in the training-school, 40 hours; teaching in the training-school, about 200 hours; critical discussion of class exercises conducted by the pupils, 40 hours.

We come now to what has long been a serious problem in American normal schools; viz., the arrangement of the curriculum, and the relation of academic to professional work. There has been a growing feeling in some parts of this country that the normal school has no business with academic training, but should confine itself strictly to professional work. I judge from last year's report to this body, that some, wishing to conform to modern sentiment but not seeing how to do so in reality, have apparently re-christened some of their departments; so that that which used to be known as academic work, has now become professional work of the strictest kind. This may look well on paper, but it only retards a true solution of the difficulty.

It may in general be remarked that the curriculum of the Prussian normal school consists of the same subjects pursued in the preparatory course, together with the theoretical and practical professional work proper. From this we may infer, what is the fact, that it is the concurrent testimony of schoolmen in Germany that no amount of theory about teaching the various branches can equal a thorough review and study of them in their relation to the teacher and the children to be taught. Academic instruction is, then, in their view, a necessary branch of normal-school instruction, and not something which, under changed conditions of preparation, might be dismissed with profit. This does not mean, however, that academic instruction in a normal school should not differ essentially from academic instruction in a high school. As I apprehend the matter, it is in this particular that we have the most room for improvement. I will explain, later, the way in which I think this improvement can be made.

No subject is pursued for less than one year, while many subjects, such as history, geography, drawing, gymnastics, and certain branches of music, are studied throughout the entire three years. Many other subjects are studied continuously for two years. This arrangement is made possible by the fact that attendance by the students is continuous throughout the entire course, whereas our broken attendance compels us to make the school term the unit of time for a study. It is curious that the number of hours per week assigned to any given subject does not exceed two, except for arithmetic and algebra, biblical history, and teaching in the training-school.

Such, in brief, is the German normal school system. But what of it? What does it mean for us? Can we attain to any such results? What are the conditions by which its development must be determined?

The average American normal school may, perhaps, be fitly defined as a high school with a training attachment, having the limitations of a low-grade high school, and the ambition of a high-grade college.

In order that the changes which I have to suggest may be seen to have some basis in reason, I wish to make certain propositions, which, since I shall not have time to demonstrate them, may be considered as self-evident truths until they are shown to be erroneous: —

1. That, since the great majority of students who enter a normal school leave at or before the end of the first year, the curriculum for this year ought to be a fair, though elementary, representation of a complete professional education. In the Illinois Normal School at Normal, seventy-two per cent of the students do not enter upon the second year's work. If the principle stated is a sound one, no great educational department ought to be entirely neglected in the first year's course; yet in our curriculum, psychology follows theory and art of education, and is found first in the second year. Again, natural science is a great and growing department of education, yet we meet its first manifestation in our course of study in the second term of the second year. I propose to put physiology, at least, into the first year's course. A little further on, I shall propose changes in the theoretical professional work.

2. That the education given in the great mass of normal schools must, in the nature of things, remain elementary in character. College and university trained teachers do not compete for positions in the district and village schools, even in old countries, where the struggle for existence is sharpest; much less are they likely to do so in this country. Schools paying from three hundred dollars to five hundred dollars only, must be filled by persons having only secondary education. Since, then, the normal school cannot compete with the college in higher education, it is idle to load up the curriculum with so many college studies, but is wiser to spend more time on fewer subjects. For example: we at Normal teach six sciences, one of which gets fifteen weeks, while each of the others is studied for a bare twelve weeks. Further, we devote six weeks to the history of education, and another six weeks to Rosenkranz's 'Philosophy of Education,' — the best yet the most difficult of works on education in the English language. It needs no argument to show the folly of making so many beginnings which lead to so little, or of making so large a contribution to the mushroom education of the times. I make the very modest proposal in regard to natural science, that astronomy be dropped, and that the two great representative sciences, physics and zoölogy, receive at least two terms each.

3. That any serious attempt greatly to raise the standard of admission will end in driving most of the male students out of the normal school. Witness the advanced State normal school at Milwaukee, which enrolls but one man. Any other normal school which demands the completion of a high-school course of study as a condition of entrance, will, I imagine, contain few male students. From this it follows, that, if the normal school is made purely professional, it is likely to become purely female.

4. That every normal school in America should teach gymnastics two hours a week throughout its entire course. It is exceedingly rare to see a stoop-shouldered or consumptive-looking man in Germany. Sitting one day in the Garden of the Luxembourg, in Paris, I began to count the number of round-shouldered people who passed. All classes were represented. Of those I counted, thirty-six were straight, and sixty-three were more or less round-shouldered, many of them seriously so. Gymnastics is thoroughly universal in all German schools, but is, or at least has not been, in France.

5. That our normal schools should make a much more serious business of music. There is not time to discuss this point.

6. That since the normal school is elementary in its scope, and since the American teacher, unlike the German, has no limits set to what he may become, the thing of most lasting benefit which the normal school can do for him and the State is to quicken him to the widest professional growth. I have little doubt that some of the early normal schools, with their one-year courses, did far more towards implanting a growing inspiration in their pupils than we do with our three years of grind. To this end I would have a more rational and far-reaching professional course of study. I propose, therefore, the following: *First year*, first term, observation; second term, elementary psychology; third term, elementary theory and practice of teaching. *Second year*, first term, logic and advanced psychology; second term, history of education; third term, philosophy of education (Rosenkranz). *Third year*, entire year, two to three hours per week, illustrative teaching, united with the principles of methodology, — a subject which, so far as I am aware, has received little or no attention in American normal schools.

7. That it is time for the normal school in America to pass that stage of its development in which it is a high school with a training attachment, and that therefore, aside from the strictly professional work, a more pedagogical treatment of the academic branches is needful. To this end I propose the following: (*a*) that the teacher in charge of any given branch should give instruction in that subject throughout its entire scope as an organic whole, and not merely

in its high-school phases; (*b*) that he should consider his subject in its rise and development as a factor in education; (*c*) that he should present an historical view of his subject in regard to methods as the best safeguard against a mechanical and slavish copying of educational devices; (*d*) that he should consider the educational function and value of his subject; (*e*) that he should treat his subject in its co-ordinate relation to the other subjects of the curriculum.

8. That, finally, since a large part of normal-school work is to fit teachers for the district and country school, it is advisable to have a type of this kind of school in the training department.

CHAS. DEGARMO.

THE CONTENTS OF CHILDREN'S MINDS.

IT will be remembered that several sets of interesting investigations have been carried on in Germany and France with a view to determine what the actual content and capacity of the child's mind are. In 1882 Prof. G. Stanley Hall tried experiments with Boston school-children, similar to those made abroad, and published his results in the *Princeton Review*. The December issue of the London *Journal of Education* contains the record of a similar investigation undertaken by an English teacher. The following abridged report of it is not only of interest in itself, but especially for the purpose of comparison with the results of the attempts elsewhere made for the same purpose. The answers were given by six children. Unfortunately, the results obtained under the heads of 'Observation' and 'Information' — the most valuable of all — are very briefly given in the original. The following are some of them: —

What is bread made of? What is the use of sleep? How would you get a garden full of flowers? What is the color of railway-signals? How do chickens come into the world? In respect to all these questions, the children failed to differentiate to any great extent. To the question 'How many legs has a spider?' A answered, "Six;" and E, "I almost think six. I killed all the spiders in aunt's garden yesterday." — "Why?" — "Oh, just for sport." To the question 'Mark the length of a foot on this bit of paper,' A marked 1 foot 3 inches; B had never heard of a foot; C, 8 inches, remarking, "Some people's feet are as long as this, aren't they?" D drew a correct foot, having toes and heel; E marked 2 inches; F, a foot and a half. To the question 'Who rules over England?' A and E answered, "Queen Victoria;" B, "The King, I don't know who the King is;" C and F did not know; and D made a rigmarole statement about railway-lamps, because he could not answer the question, but wished to show that he knew something else.

The questions were put to each child alone, and they had no opportunity for talking about them with their companions. The questions were introduced after a friendly talk with the child, and after shyness had somewhat worn off. The attempts to draw out a child's moral notions almost invariably failed, as the children grew shy. The children are indicated by letters. A, B, and C were girls, aged respectively 8, 7, and 6. A was F's sister, and came from a cultivated home, as did all but C. D, E, and F were boys, aged respectively 7, 7, and 6. A had been running wild for weeks, F for months. D had attended school for a short time. C and F had had home teaching. The children enjoyed the questioning greatly, and it was more difficult to keep them to the point than to extract answers from them.

Below are given a selection of the questions and answers, under the heading of the faculty which they were designed to test: —

Reasoning Power.

1. Why do children have to go to bed so much earlier than grown-up people?

A. Because it is better for them; I don't know why. Is it to make them strong?

B. Because they are not so old. I don't know any thing else.

C. Because they are little. To make them get up early.

D. Because they get so tired. I think it is a good plan.

E. Because they get so tired, and because they are smaller.

F. Because children are younger, and they must get more sleep, and that they don't get so tired as grown-up people.

2. If your porridge is hot, why do you eat the outside edge first?

A [had never heard of porridge, so took soup]. Because it would be cooler. I don't know why.

B [pea-soup taken]. Because it is colder; because the edge of the plate goes round it.

C [porridge]. The edge, because it is cooler, because the plate is cold.

D. I should eat the edge first because it is cooler; because it touches the mug, and the mug is cold.

E. Round the edge because it is coolest, because it is against a cold basin.

F [had heard of, but never seen, porridge; soup taken]. Because it is cooler. I don't know why it is cooler.

3. Do crossing-sweepers like fine or wet weather better? Why?

A. Wet, because they have more crossings to sweep, and will get more money.

B. Fine, because it does not rain.

C. Wet weather, because they get more money.

D. Fine, because he can be outter more, and can sweep the roads more. Do they get money for it? I should not do it unless I had money given to me.

E. Fine weather. Well, perhaps they do like wet weather for more sweeping. They like it wet, and then to leave off raining while they sweep.

F. Wet, because they get more money, because people don't want to walk in the mud.

4. What is the good of going to school?

A. To learn your lessons; to learn every thing. ["Will you have learnt every thing when you leave school?"] No. ["Then why don't grown-up people go to school?" A looked puzzled, then said] Because they know what little people don't, but they don't know every thing.

B. To learn to write and to play.

C. To get you clever. I think every one gets clever who goes to school.

D. Because it teaches you to know things when you grow up. ["What things?"] Oh! about trains and how the lines are made and laid down, and all that — and — Oh! [he looked quite awe-struck] is it not a wonderful thing how an engine is made?

E. To learn things; reading and writing, sums, and the multiplication-table.

F. To learn something. I don't know any thing else.

5. I gave the child several sticks of the same length, and asked it to make a cage for a bear with four sticks, so that it could not get out; then with three sticks, then two.

A. I don't know how. ["Try."] How big is the bear? [Gave a piece of paper to represent bear.] First took five sticks, then right with four, then right with three. ["Now try with two."] Promptly, "I can't, unless the bear can get in here," putting the sticks side by side, and she slipped the bit of paper between, but said at once, "It would slip out at the end."

B. Did all right; tried a little with two sticks, then said emphatically, "No."

C. Four and three right at once; when asked to try two, said roguishly, "I'll have to make a cage with one next, I can't do it with two."

D. Four, right; three, first wrong, then right; with two, tried again and again, and needed help to see that it could not be done.

E. Four and three, right; then said, "I don't know how we are going to manage with two." He tried, but at once gave up.

F. Four, right; three, "I can't;" then, very quickly, "Yes, I can" — right. Tried two, but said at once, "No, I can't."

Imagination.

1. What is the moon?

A. A light.

B. A man. I don't know why I think so.

C [laughing]. *We* call it a cheese, but it isn't really. I don't know.

D [reverently]. The moon is God. ["Is that exactly what you mean?"] No; I mean because God made the moon; I don't know what it is at all.

E. I know it is a big thing, and I think to myself it's something like the sun: it shines just as bright.

F. Don't know, never thought.

2. What is thunder?

A. When clouds meet together and make a great noise; when they bang together.

B. Don't know.

C. Thunder makes a noise, that's what it is.

D. Long pause; then, "Is thunder God? Well, God sends thunder, does not he?" Then followed a long outpour on the folly of standing under a tree during a thunder-storm.

E. A rolling thing that makes a great deal of noise, that's what it is.

F. Nasty little beasts. Further inquiry brought out, "It kills nasty little beasts that eat the cabbages."

3. If you went up in a balloon higher and higher, what would you come to at last?

A. The sky. The sky is heaven. [Very shyly] I forget what heaven is.

B. We should come to the sky: the sky is water.

C. I don't know.

D. I don't know; but I know if you go up high enough you can't breathe [here followed remarks too numerous and rapid to be taken down].

E. Clouds and heaven.

F. Come to the sky. I don't know what the sky is.

4. What age do you think it would be nicest to be, and why?

A. I don't know. I don't want to grow older all of a sudden.

B. Twelve [but she was too shy to tell me why].

C. Seven, because it is a year older, because then I should not have to go to school so long.

D. Nine, because I think then I should know a little more.

E. Well, for myself, I should think about thirty, because you would be of age, and could do nearly what you liked. I should go to theatres and cricket, and play football and run races. ["Shall you do any work?"] Oh, yes! ["What should you do?"] Well, if I had my own choice, I should not mind being a coachman, that's what I like — *horses*. ["Do you like dogs too?"] Well, I haven't had much to do with dogs.

F. Twenty, because I could wear trousers then — and what age would *you* like to be?

5. What do dogs think about? Can they talk to each other? How?

A [much amused]. Oh! I don't know; I don't know if they think or not. They talk in their way, I don't know what they say.

B. Don't know. I don't think they do think. No.

C. They don't think at all, do they? They can bark, not talk properly, but they understand each other.

D. Think about nothing but eating. No, except they can bark.

E. *Some* dogs think about biting people, some about eating things, and some dogs think about being kind to people. They talk in a dog language that people can't understand.

F. Biting and fighting. I don't know any thing else. Yes, they bark.

6. If you could go to the bottom of the sea, what should you expect to see?

A. Sand and stones and fish. I don't think there is any thing else.

B. Animals, fishes, sand, and stones; nothing else.

C. You would not see any thing, because it is so dark when you are under the sea.

D. I have never seen the sea. ["Tell me what you think it is like."] It's blue, and the waves come up higher than this chair. I should see a lot of sand, and a lot of shells, and a lot of fishes, and a lot of crabs. They bite your legs dreadfully, crabs do.

E. Fish and shells, seaweeds, and some boats, perhaps, that had sunk; jelly-fish, I dare say, and I've heard [very mysteriously] that there are mermaids, but I don't think so, do you?

F. Fishes, people which have been drowned.

7. What are fairies? Where do they live?

A. There aren't such things.

B. Don't know. They are fairies; they are just fairies. I don't know where they live.

C. Don't think I ever heard of them.

D. Fairies are spirits: they look rather like an angel. Yes, rather. We can't see angels; there might be an angel in this room, and you and I could not see it. Angels are so light, any one could lift an angel. When Jesus was on earth there were angels. Do you know what wonderful things Jesus could do? [A fluent story of the paralytic man followed.] That was years ago, they don't do such things nowadays. Fairies live under trees; acorns are their teacups.

E. I know there are those, because there was one screamed out to mother. Very little things, I expect, not much larger than this [he measured about an inch and a quarter]. They live in the woods and under toad-stools. I expect they come into our houses at night.

F. There are none.

Sense of Beauty.

1. What flower do you think the prettiest, and why?

A. Oh! they are all so pretty; I don't know. ["Suppose I promised to give you a nosegay of several pretty flowers, which would you choose?"] Forget-me-nots and violets and daisies and may-blossoms; I don't know what else.

B. Gardinias, because they smell so nice.

C. A rose, because it is a very pretty flower; there is nothing else like a rose.

D. A sunflower, I think, don't you? ["I think I like some others better."] Oh! but just you remember how long they last, and those tiny flowers don't last very long. I say [very confidentially], do you like bread-and-butter pudding? ["Not much."] I'll tell you what I like, and I am sure you will too, and that's suet-pudding smoking hot with raisins in it [a long outpour on puddings followed].

E. A rose. It has a lot of sort of little things inside, petals, red and yellow, cream-colored and white.

F. A white rose. I like them because I think them prettier than any other flower. I don't know what it is like. I can't tell you.

2. What is the most beautiful thing you ever saw?

A. Don't know [thought hard, still didn't know. "Have you seen any beautiful thing lately?"] Yes, the sea, when it is calm, and sometimes when it's rough.

B. Roses.

C. Stuffed animals and things.

D [thought a long time, then asked] An animal? ["Just as you think, any thing."] Well, then, I think an air-ball; how difficult they must be to make! [Too rapid a description followed to be taken down.]

E. I like the mountains very much. ["Have you ever seen any?"] Oh! I've been to Italy and France and Paris. I was very little, but I remember the mountains.

F. I don't know. [He thought hard, and then said, almost as if watching them] Fireworks, sky-rockets, lovely!

BOOK-REVIEWS.

Grundzüge der physiologischen Psychologie. Von WILHELM WUNDT. 2 vols. 3d ed. Leipzig, Engelmann. 8°.

PROFESSOR WUNDT of the University of Leipzig has indelibly associated his name with the development of the scientific study of

mind that plays so prominent a *rôle* in the science of this century. Beginning his career as a physiologist, he soon saw in the pursuit of his specialty the opportunity of bridging over the gap between body and mind, or, better, of restoring to its original unity the study of the two as different aspects of one phenomenon. The field of physiological psychology had been simply touched upon here and there. It lacked systematic treatment as well as recognition as a distinct science. Both of these he attempted to supply; and the attempt, considering the inherent difficulty of the subject, has been eminently successful. He published the first systematic text-book in this field in 1874, a second and much enlarged edition appeared in 1880, and the third has just appeared. In these thirteen years the growth of the science has been rapid, and the fact that the validity of this increase is in great part not yet tested makes it necessary to record much that our successors will be able to omit. But independently of this technical aspect of the study, science owes a debt to this movement similar to that it owes to Darwin. The one introduced the same rejuvenating ferment into the discussion of philosophical problems as has the other into that of biological problems. It has given meaning to facts formerly isolated and uninterpreted, has erected a sign-post directing the way for the future, and has prevented much useless and irrelevant speculation. It is to be hoped that the objects and methods of this science are to-day too well known to need more than a mention in this connection.

The question of most natural interest in the notice of this text-book is the extent and nature of the changes that have been made in passing from the second to the third edition. While the author has made alterations in all parts of the work, the topics that have been most altered are the following, and they indicate very well the fields in which recent research has been active. The anatomy and physiology of the central nervous system, and particularly of the parts connected with the highest psychic activities, have been much revised. Next, the experimental study of sensation, both qualitatively and quantitatively, has received valuable additions from many hands. The chapter on auditory perceptions has been rewritten, and that describing the measurement of the times of psychic processes has been made to include the most recent studies, especially those made in Professor Wundt's own laboratory. Whether these changes justify the publication of a new edition is a question upon which opinions will differ. A great deal of what has been added has been already published in the *Philosophische Studien*, edited by Professor Wundt; and, as most of this material is only of technical interest, its incorporation into a text-book is hardly an advisable step. Again, the advance in the knowledge of facts has brought with it an advance in the presentation of theoretical views, and Professor Wundt has hardly undertaken the radical kind of revision that the appreciation of these would justify: in other words, if a text-book in physics were written upon the plan of this work, it would amount to a cyclopædia, and the reader of that cyclopædia would be at a loss to distinguish the important and clearly established from the unessential and provisional. The book has grown thicker where it should have grown deeper. Finally, at the risk of singling out a trivial matter, an American reader is very much struck with the absence of all mention of the studies that have been contributed to this science on this side of the Atlantic within the last few years. These studies to a large extent fall in those chapters that have been most fully revised; and this, together with the fact that they have been noticed in Professor Ladd's 'Psychology,' makes the cause of this omission all the more strange.

Spezial Karte von Afrika. Gotha, Justus Perthes. f°.

THE second edition of this valuable work on African geography is now complete. It consists of ten sheets, and contains all the new discoveries made during the last years. The coloring of the new edition is more delicate than that of the first edition, and the political boundaries have been indicated in colors that do not obscure the physical features of the country. The map is carefully compiled from all the available material, and is indispensable to the student of African geography. Although it is only a year since the first edition was completed, the additions to our knowledge of some parts of Africa are so considerable that the sheets had to be practically redrawn. On the sheet Kongo we find the results of Capello and Ivens's journey, Reichard's journeys west of the Tanganyika, and the numerous explorations on the tributaries of the Kongo. The contour line of 1,000 metres, which was indicated by a heavy buff line in the first edition, has been corrected according to recent observations, and is shown by a broken red line. Another technical improvement of the new edition is the use of a dark green color for indicating oases. On the sheet Western Sudan we find A. Krause's important journey through Mosi indicated, although the details are not yet known. The leading principles in constructing the map are thoroughly scientific. The lettering and the outlines show plainly the parts that are known by exploration, and those which are only known by reports of natives. The scale is 1 : 4,000,000 (about 60 miles to an inch), large enough to show all important features of the geography of Africa.

The Driftless Area of the Upper Mississippi. By T. C. CHAMBERLIN and R. D. SALISBURY. (A monograph accompanying the Sixth Annual Report of the Director of the United States Geological Survey.) Washington, Government. 4°.

IN no direction is the Geological Survey advancing the science more rapidly than in the department of glaciology. The monograph on the great terminal moraine has done more than any other single research to make the continental ice-cap a reality, and to silence the iceberg theory of the drift; and the present contribution is scarcely less valuable or wide-reaching in its conclusions.

In the midst of the great mantle of drift that overspreads the Upper Mississippi basin, there lies a drift-barren tract of about ten thousand square miles, — the driftless area of Wisconsin and adjoining States. This island in the sea of drift is unique; and, strangely enough, the margin of the drift on almost every hand lies on a slope descending toward the driftless area. Probably no other district on the globe is so favorably situated to serve as a standard of comparison and contrast between glaciated and unglaciated areas, and a means of estimating the results of the drift agencies. All of the formations of that region, with their attendant topographies, sweep curvingly across the driftless area from an ice-ridden region on the one hand, to a like ice-ridden region on the other, displaying in a most striking manner the contrasts that arose from the single factor of glaciation. The driftless region is especially instructive concerning glacial extension and restriction, and it throws important light upon the movements of the ice-sheet over a very large adjacent territory. The great drift-burdened ice-stream, as it moved south-westward from the Canadian heights, was divided and diverted; and the separated currents swept around the area, and mingled their burdens below it.

The facts bearing upon these and many minor aspects of the driftless area are marshalled and discussed in a masterly manner, the more important features being also clearly exhibited in a series of well-executed maps and cuts. Among the subordinate contrasts which this region presents, none are more noticeable than the absence of falls in the driftless area, and their comparative abundance beyond its limits, — falls indicating a youthful, and usually a post-glacial, topography. And certainly there could be no more convincing evidence that the region has never been invaded by glaciers than is to be found in the fragile pinnacles of rock which abound over a large part of its surface.

The residuary earths of the driftless area are compared physically, microscopically, and chemically with the glacial clay or till. Nearly one million measurements of the ultimate particles show that the residuary earths are much finer grained and more homogeneous than the drift clay; and they are also remarkably free from calcareous matter, which forms a large proportion of all the true drift of that region.

In its remarkably sinuous course across the continent, the great terminal moraine impinges upon the eastern side of the driftless area, and affords specially fine contrasts between the characteristics of driftless and drift-bearing regions; while upon the west it is bordered by the loess; and the much-disputed question as to the origin of this interesting formation is settled provisionally in favor of its being essentially an aqueous or lacustrine deposit of glacial clays.

In the concluding chapter, on the history and genesis of the drift-

less area, it is shown more clearly that the marginal phenomena confirm Professor Chamberlin's previously published classification of the quaternary epochs. He recognizes (1) an earlier glacial epoch, in which two successive ice-sheets were separated by an interglacial period sufficiently marked to permit the growth of vegetation over the surface; (2) a prolonged interglacial epoch, during which the land was elevated to the extent of eight hundred to one thousand feet, and again forest-clad; (3) a later glacial epoch, during which the great terminal moraine was formed, while subordinate moraines and vegetal deposits testify to repeated recessions and advances of the ice; (4) the Champlain epoch, during which marine and lacustrine deposits were formed; (5) the terrace epoch, when the streams carved the flood-plains of the Champlain epoch into terraces.

The origin of the driftless area is found in the fact that the elevated land lying north-east of it must have acted as a wedge to divide the ice, while the diverging troughs of Lake Superior and Lake Michigan tended to prevent the streams from re-uniting immediately south of the obstruction. Climatic influences also probably played an important part in staying the progress of the ice which was advancing directly toward the driftless area. In the language of the authors, diverted by highlands, led away by valleys, consumed by wastage where weak, self-perpetuated where strong, the fingers of the *mer de glace* closed around the ancient Jardin of the Upper Mississippi valley, but failed to close upon it.

A History of Elizabethan Literature. By GEORGE SAINTSBURY. New York, Macmillan. 12°. $1.75.

THIS book forms the second part of a general history of English literature from the earliest period to the present day. The whole work will be completed in four volumes, by four different writers, each specially qualified for his individual task. Mr. Saintsbury has been for many years an enthusiastic student of the period of which he treats, and he here gives the main results of his studies in a clear and well-ordered form. He wisely confines himself in the main to the purely literary aspects of his subject, with much less attention to biography and bibliography than some writers would give. He allows considerable space to the minor writers, a knowledge of whom he thinks essential to a correct understanding of the period. His enthusiasm for his subject is almost unbounded, and some readers will think it excessive. He styles the Elizabethan era "the greatest period in the greatest literature of the world," and seems too little aware of its defects. His admiration for Shakspeare is carried to the verge of idolatry, and he does not appear to see any faults at all in him.

Spenser he esteems almost as highly, and thinks the 'Faërie Queen' the greatest poem in the English language. With regard to the forms of poetry, he maintains that "every English metre since Chaucer at least can be scanned, within the proper limits, according to the strictest rules of classical prosody," — an opinion with which very few persons will agree. The greater part of the book is of course devoted to the writers of verse, yet the prose writers are treated with sufficient fulness. Bacon, in Mr. Saintsbury's opinion, was more of a rhetorician than a philosopher, and might better have gone into the Church than into politics. Hobbes is spoken of as the first prose writer whose style is clear and uninvolved; while the general style of the period is well characterized in the remark, that at that time "the sense of proportion and order in prose composition was not born." Mr. Saintsbury's work, notwithstanding some defects, will be valuable both to the student and to the general reader; and, if the other volumes of the series are equally well done, the whole work will be the standard history of English literature.

Hegel's Philosophy of the State and of History. By GEORGE S. MORRIS. Chicago, Griggs & Co. 16°.

THIS book is the sixth in the series of philosophical classics now in course of publication under the editorial supervision of Professor Morris. It gives in a brief, by no means superficial form the theories of Hegel on the constitution of the state and of civil society, and also on the philosophy of history. Hegel's terminology is so strange to the English reader, and his processes of thought often so obscure, that it is not an easy task to make his meaning plain and comprehensible, but Professor Morris has succeeded in doing this as well as could be expected. The theory of the state which the German philosopher has given is not in all respects such as the people of a free country are likely to accept. He repudiates the intention of describing an ideal state, such as Plato and others have dreamed of, and he has little respect, apparently, for such attempts on the part of others; yet it is not difficult to see that a constitutional monarchy is in his eyes, if not an ideal state, at least the most perfect type that has yet been devised. He divides the powers of government into three classes, — the legislative power, the executive power, and the power of ultimate decision, which properly resides in the monarch alone. He is strongly in favor of a representative assembly to take part in legislation, but he regards with great distrust the influence of public opinion, which is the inevitable consequence of representation. On the subject of war, Hegel is not in accord with the peacemakers, his view being that "war is to nations what wind is to the sea, — it preserves them from stagnation and putrescence."

On the subject of history the views of Hegel are in some respects a little behind the age, owing partly to the new theories of development which now prevail, and partly to the discovery and interpretation since his time of the ancient records of Egypt and Assyria. Still his theories are well worth pondering. He holds that history as a whole is "the development of the conception of freedom," — a remark that seems to apply rather too exclusively to mere political history. He passes in review the history of the leading nations, briefly characterizing the civilization of each, and showing the connection of them all with the life of modern Europe. In the course of this exposition he has many interesting observations on special points which we should be glad to quote if space permitted, but we must content ourselves with recommending our readers to look them out for themselves.

NOTES AND NEWS.

IN compliance with what seems to be a wide-spread desire on the part of the geologists of America, a few have united in an effort to establish an American journal devoted to geology and its allied sciences. The subscription price is three dollars per year, and the place of issue for the present is Minneapolis, Minn., where correspondence should be addressed to *The American Geologist.* From all geologists the editors solicit original contributions and items of scientific news. The editors and publishers, for the year beginning Jan. 1, 1888, are as follows: Prof. S. Calvin, Iowa City, Io.; Prof. E. W. Claypole, Akron, O.; Dr. Persifor Frazer, Philadelphia, Penn.; Prof. L. E. Hicks, Lincoln, Neb.; Mr. E. O. Ulrich, Newport, Ky.; Dr. A. Winchell, Ann Arbor, Mich.; Prof. N. H. Winchell, Minneapolis, Minn.

— A company has been incorporated for building a railroad from Winnipeg to Fort Simpson, British Columbia, crossing the Rocky Mountains by way of the Peace River Pass. This is one of the routes surveyed by the Canadian Pacific Railroad. It was recommended, as the distance from Fort Simpson to eastern Asia is still shorter than that from Vancouver. Part of the country through which this road would pass is suitable for agricultural purposes. The charter compels the incorporation to build at least fifty miles each year, the whole distance being a little more than sixteen hundred miles.

— The second number of the bibliographies of Indian languages by James C. Pilling has just been issued by the Bureau of Ethnology. It treats of the Siouan stock. The plan of this bibliography is the same as the one followed in the 'Bibliography of the Eskimo Language,' which was referred to in No. 235 of *Science.* The dictionary plan has been followed to its extreme limit, the subject and tribal indexes, references to libraries, etc., being included in one alphabetic series. The arrangement is excellent, and makes the bibliography very handy for use.

— The Pennsylvania State College Agricultural Experiment Station was established by vote of the trustees June 30, 1887, in accordance with the provisions of the Hatch act, and will continue and greatly enlarge the experimental work of past years. It investigates such subjects as are of immediate importance to the farmer of the State, and publishes the results in reports and bulletins, which are distrib-

uted free of charge to all citizens of the State who apply for them. Specimens of agricultural products, when of public interest, are examined and reported upon free of charge. The board of directors is as follows: H. P. Armsby, Ph.D., director; William Frear, Ph.D., vice-director and chemist; William A. Buckhout, M.S., botanist; George C. Butz, B.S., horticulturist; William C. Patterson, superintendent of farm. Correspondence is invited, and inquiries upon agricultural matters will be answered as far as possible. Address Agricultural Experiment Station, State College, Centre County, Penn.

— We learn from *Nature* that in a Russian paper of Oct. 22 last, appears a preliminary report of the examination by Latschinof and Jerofeief, professors of mineralogy and chemistry respectively, of a meteoric stone weighing four pounds, which fell in the district of Krasnoslobodsk, Government of Pensa, Russia, on Sept. 4, 1886. In the insoluble residue, small corpuscles showing traces of polarization were observed. They are harder than corundum, and have the density and other characters of the diamond. The corpuscles are said to amount to one per cent of the meteoric stone. Carbon, in its amorphous graphitic form, has been long known as a constituent of meteoric irons and stones. Lately, small but well-defined crystals of graphitic carbon, having forms often presented by the diamond, were described as having been found in a meteoric iron from western Australia. If this supplementary discovery be confirmed, we may at last be placed on the track of the artificial production of the precious stone.

— The loss of electricity by a conductor in moist air, says *Nature*, has been lately studied by Signor Guglielmo (Turin Academy). He finds that with potentials less than 600 volts, moist air insulates as well as dry air, but with higher potentials there is more loss in moist air, and more the moister the air and the higher the potential. The potential at which the difference becomes perceptible is the same for a ball as for a fine point. It occurs with extremely smooth surfaces, and so cannot be attributed to discharges in consequence of roughness of surface. With equal potential, the loss of electricity has the same magnitude, whatever the dimensions of the balls used as conductors. In air saturated with vapors of insulating substances, the loss of electricity of a conductor is nearly the same as in dry air.

— According to *Nature*, frozen fish are now imported into France, and a society formed in Marseilles for the purpose of developing the trade (the Société du Trident) has a steamer and a sailing-vessel engaged in it. The steamer 'Rokelle' lately came into Marseilles with some 30,000 kilograms of frozen fish in its hold, the temperature of which is kept at 17° C. below zero by means of a Pictet machine (evaporating sulphurous acid). The fish are caught with the net in various parts of the Mediterranean and Atlantic. After arrival they are despatched by night in a cold chamber. Experiment has shown that fish can be kept seven or eight months at low temperature without the least alteration. These fish are wrapped in straw or marine algæ, and have been sent on to Paris, and even to Switzerland.

— We learn from *Nature* that the fourth session of the International Geological Congress will be held next year in London. The congress was founded at a meeting of the American Association for the Advancement of Science, at Buffalo, in 1876, the first session being held at Paris in 1878, the second at Bologna in 1881, the third at Berlin in 1885. The following is a list of the organizing committee appointed to carry out the arrangements: H. Bauerman; W. T. Blanford, F.R.S.; Rev. Prof. T. G. Bonney, F.R.S.; Prof. W. Boyd Dawkins, F.R.S.; John Evans, F.R.S.; Prof. W. H. Flower, F.R.S.; Arch. Geikie, F.R.S.; Prof. James Geikie, F.R.S.; Sir Douglas Galton, F.R.S.; Prof. A. H. Green, F.R.S.; Rev. Prof. S. Haughton, F.R.S.; Prof. T. H. Huxley, F.R.S.; W. H. Hudleston, F.R.S.; Prof. T. McK. Hughes; J. W. Hulke, F.R.S.; Prof. E. Hull, F.R.S.; Prof. J. W. Judd, F.R.S.; Prof. J. Prestwich, F.R.S.; F. W. Rudler; H. C. Sorby, F.R.S.; Sir W. W. Smyth, F.R.S.; W. Topley; Rev. Prof. Wiltshire; Henry Woodward, F.R.S. The duty of this committee will be to nominate the officers, to appoint executive committees, and to fix the exact date of meeting. The congress at Berlin requested that the meeting should be held in London between Aug. 15 and Sept. 15.

— The theory is advanced by Professor Mendeleef that petroleum is of mineral origin, and that its production is going on, and may continue almost indefinitely. *Engineering* states that he has succeeded in making it artificially by a process similar to that which he believes is going on in the earth, and experts find it impossible to distinguish between the natural and the manufactured article. His hypothesis is that water finds its way below the crust of the earth, and then meets with carbides of metals, particularly of iron, in a glowing state. The water is decomposed into its constituent gases; the oxygen unites with the iron, while the hydrogen takes up the carbon, and ascends to a higher region, where part of it is condensed into mineral oil, and part remains as natural gas, to escape where it can find an outlet, or to remain stored at great pressure until a bore-hole is put down to provide it a passage to the surface. Oil-bearing strata occur in the vicinity of mountain ranges, and it is supposed that the upheaval of the hills has dislocated the strata below sufficiently to give the water access to depths from which it is ordinarily shut out. If the centre of the earth contains large amounts of metallic carbides, we have in prospect a store of fuel against the days when our coal will be exhausted.

— In 'Notice to Mariners,' No. 94, published by the United States Coast Survey, some very interesting information is given regarding the Gulf Stream. Between Rebecca Shoal and Cuba the current was found to vary in velocity, the maximum velocity arriving about nine hours and twenty minutes before the transit of the moon, and between Cuba and Yucatan the greatest velocity was found at ten hours before the moon's transit. The greatest velocity of the current was observed fifty-one miles south of Rebecca Shoal, at which point the stream moved 3.73 knots per hour. Between Yucatan and Cuba the stream's greatest velocity was 6.32 knots, about thirty miles from Yucatan toward Cape San Antonio.

— The United States Coast Survey Steamer 'Blake,' Lieut. J. E. Pillsbury commanding, will continue the investigation of the Gulf Stream currents during the coming winter and spring months at the places mentioned below; and shipmasters, when in the vicinity, are requested to look out for and keep clear of her. During January and the first part of February the 'Blake' will be anchored about six hundred miles north-east of Barbadoes Islands, and in the track of vessels bound to the United States from the South Atlantic or off the South American coast to the eastward of Trinidad Island; the last part of February and until May, between the West India Islands, commencing at Trinidad, and ending at the old Bahama channel. When at anchor, she will hoist three balls from the fore-topmast stay, and at night-time she will show from the same point three lights, — red, white, and red.

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Conspiracy of Silence.

I THINK your correspondent (Dec. 16, p. 298) is unjust to Professor Bonney, placing a meaning on his words which they will indeed bear, but which was not Professor Bonney's meaning. I am not a Darwinist, and have never accepted the Darwinian hypothesis so called; and I can therefore dispassionately defend Professor Bonney. But I should like to volunteer a rather unnecessary defence of men of science as a class, whether Darwinists or anti-Darwinists, whom your correspondent attacks indiscriminately. 'Conspiracy' is an ugly word; and it is, as both Professor Huxley and Professor Bonney assert with good reason, not only an ugly word, but an improbable thing; and not only improbable, but (as the scientific world is now constituted) impossible in a large way. A conspiracy within the limits of one scientific institution, to suppress a paper, may be planned and executed with some success by one or more of its officers and one or more of its members opposed to the writer of that paper. Thus far, but no farther, can a scientific conspiracy go. The thing has been often done, and will be often done; but it is a foolish thing to do, perfectly futile, injurious to the society in which it happens, and in the end injurious to the conspirators. But the writer of a paper, if it be a good one, can find many other ways of publishing it, without encountering a con-

spiracy. If it be a poor paper, it will probably be suppressed several times before it gets published; and no one is to blame for that but its author. But a general conspiracy among men of science to suppress views because they are new, and unacceptable to old fogies, is impossible; and your correspondent and the Duke of Argyll must certainly know that fact; and it will remain a fact, in spite of any number of instances of special local repression that can be cited. When such repression happens, the fault lies with the man of new views, who will not or can not speak out boldly; who will not or can not make his conclusions irresistibly; who is too shy, or too limited in his personal associations, or too obscure in his language, to compel general attention to what he believes.

Younger men of science with new ideas seem to think that older men in science have no business of their own to attend to, but must drop all their personal investigations to discuss and investigate, prove or disprove, each new theory as soon as it is promulged. The fact is, every new presentation in any department of science is read with interest and attention by scores, hundreds, and in some rare cases by thousands, of experts working in that particular department. But, if it be an important new theory, it requires, on that account, to be carefully studied; which, of course, takes time, — months, sometimes years. The delay will always be in proportion, first to the importance, and second to the difficulty, of the subject-matter of the theory. The few whom it most interests are separately making up their minds about it, and consulting each other. The wisest and strongest minds take the longest time, resisting all pressure to force them to a premature conclusion. But there is a personal equation. Men of science differ greatly in their reticence and in their cautiousness. What is denounced by the author of the novelty, and by his friend or friends, as a conspiracy of silence, and a scandal to science, is in fact the involuntary cautiousness of men who know much and have been often mistaken; and it is the glory of science that it keeps its head level, as it keeps its eyes open and its heart warm. Let your correspondent reflect that there are two natural classes of men of science, — the daring and useful, and the cautious and useful. Both classes are equally useful and equally honorable; and the charge of a conspiracy of silence can no more justly be brought against the one class than the charge of a conspiracy of notoriety against the other.

Whenever "Mr. Bonney says that the scientific method is to wait, and not to investigate," I shall go to London to ask him what he can mean by such language; but if I have to wait until he actually says so foolish a word, I shall never again see London. In fact, Mr. Bonney never has said any thing of the sort, in the sense assigned to his words by your correspondent; meaning by 'scientific method' the mode of pursuing truth proper for all the pursuers of truth. What he meant in his rebuke of the Duke of Argyll is evident: he meant that any one man of science not engaged in a given special line of research can not and dares not make up his own mind as to the validity of one of two opposing theories until those others who have that special line of research in hand have practically reached some consent on the subject.

Your correspondent's quotation from Professor Bonney (on p. 299, footnote) does him another injustice. Mr. Bonney writes, "Very well, but there are some people, not very few in number, who do not share the opinion." Your correspondent exclaims, "Hail to the new science! The voice of many people is the voice of God." But the people of Mr. Bonney are not the people of Mr. Buel. Professor Bonney has said plainly enough that by 'people' he means such men as Darwin and Dana, the greatest investigators of these special coral phenomena. If Mr. Murray's 'people' are numerous, Mr. Darwin's and Mr. Dana's 'people' are also numerous. Most of the 'people' on both sides are of no value as reasoners on coral formation; but a few — a very few on both sides — have some right to an opinion. But Mr. Huxley and Mr. Bonney do not claim to be of these few — on either side. Of course they wait.

It is a curious fact, and rather pathetic withal, that a man of science seldom or never opens his mouth but he puts his foot in it. At all events, there is always some half-man of science standing by ready to say so, and run for a doctor. But curious and even pathetic as the fact may be, it has its good and its bad consequences: it makes thoroughbred experts more cautious, both in framing their own opinions respecting the researches of others, and in expressing such opinions publicly; and it makes experts of the second, third, and fourth order of breeding correspondingly reckless in both thinking and speaking. J. P. LESLEY.

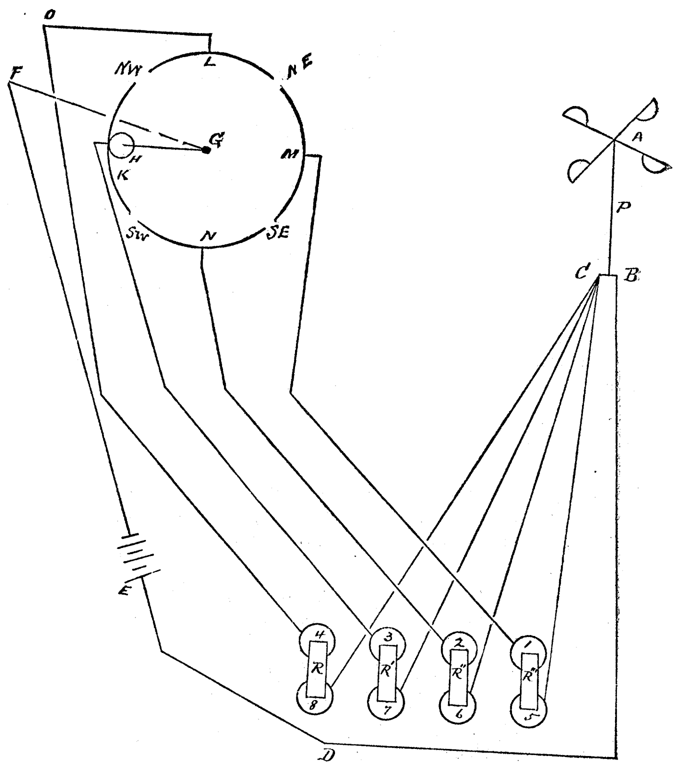
Philadelphia, Dec. 19.

A Wind-Register for Direction and Velocity.

FOR some years it has been considered very important that not only the total amount of wind should be recorded on self-registers, but that some simple means should be brought into use by which the recording sheet should give directly the number of miles or kilometres per hour of wind blowing from the various points of compass.

The plan usually adopted is to mark off on the velocity record the spaces of time during which the wind was blowing from the various quarters as indicated by the record sheet for the directions, or the direction is stamped on the velocity sheet at regular intervals of time (say, every ten minutes) by the automatic closing of an electric circuit by means of a clock.

A method of registering the wind's velocity so as to give a minimum amount of labor in reading the recording sheet has suggested itself to me, and I have given below a short account of the principles of construction. I do not remember having seen mention of



such an apparatus before, but it is so simple that it is probably not wholly new; and a similar form of instrument may even be in actual use, but, if so, I cannot recall any such, and I am somewhat familiar with the instruments of the various meteorological observatories.

In the accompanying figure, A represents the Robinson anemometer; P, the supporting frame; and C and B, the posts to which the conducting wires are attached in the ordinary form of electrical self-registering anemometer, in which C and B have metallic connection through P at the completion of each mile or kilometre of wind as shown by the anemometer dial: at other times the connection between C and B is broken. By means of a wire, B is connected with one pole of the battery E. Wires also pass from C to binding-screws on 5, 6, 7, 8, electro-magnets of the recording apparatus.

The left-hand part of the diagram is shown in horizontal plan. G is the lower end of a rod passing from the roof to the room beneath. This rod being in rigid connection with the wind-vane, it will revolve with the latter. Near the lower end of the rod, at G, an arm is placed at right angles to the rod, and terminates in the small friction-wheel H.

This wheel H runs along a metallic rim encircling G; the rim not being continuous, but having small breaks at the points touched by the wheel H when the vane points $N E$, $S E$, $S W$, $N W$. These breaks are so short that when H, in its revolution around G, leaves one segment of the rim, it almost instantly rests against the next.

The segment L is connected with the binding-screw of 4, by the wire passing through O. Similarly K is connected with 3, N is connected with 2, and M is connected with 1.

The wire $G F$ is in metallic connection with $G H$, and is also connected with the free pole of the battery E.

We will now suppose that the anemometer and vane are exposed to the wind, and the wind is from the west. We shall then have the arrangement shown in the diagram.

The metallic connection $C\ 7\ 3\ K\ H\ G\ F\ E\ D'B$ will be complete; and whenever the anemometer closes the circuit $B\ C$, the armature R' will be attracted by the double coil magnet 3 7. So, for any winds between $S\ W$ and $N\ W$, the armature R' will indicate each mile or kilometre of wind. Similarly the armatures R, R'', R''' will indicate northerly, southerly, or easterly winds.

By attaching recording pencils to the armatures R, R', R'', R''' and allowing a chronograph sheet to pass beneath them, we can register in separate columns the amount of wind from the four points. By doubling the number of segments, electro-magnets, and recording pencils, the velocities can be recorded for eight points of compass.

The recording pencils can be made to register their marks in lines running side by side and parallel, and within narrow limits, by bending the pencil-holders attached to the armatures in such a manner as to bring the pencil-points close together, and into an alignment transverse to the motion of the recording sheet.

In reading the record sheet, the sums of the registrations in the separate columns will give directly the amount of wind blowing from the different quarters.

So far as the apparatus for wind, direction, and velocity is concerned, the method that I have here described is applicable to most of the electrical registering anemoscopes and anemometers now in use, with very little change; but the registering apparatus (chronographs, pencils, electro-magnets, etc.) will require more alteration, especially for the American form of cylinder chronograph. The European chronographs, with the long narrow paper strips for recording sheets, will answer the purpose very well, and they are usually of much better construction than the cheaper American chronographs.

In actual practice a single wire connecting $C\ 5\ 6\ 7\ 8$ would be used in place of the four wires shown in the diagram ($C5$, $C6$, $C7$, $C8$).

It might perhaps also be found best to make a continuous record of the wind direction by means of a cylinder encircling the rod G with a sliding pencil, the motion of this last being regulated by the chronograph clock-work. FRANK WALDO.

Cincinnati, O., Dec. 14.

American Microscopes.

THE complaint which Dr. Minot makes in a recent number of *Science* (x. No. 252) about the tendency of American microscope-makers to furnish instruments which are much more decorative than useful, and which are seriously lacking in the optical excellence which the genuine scientific worker requires, expresses, I think, the feeling of every one who is frequently called upon to purchase microscopes, or advise about their construction.

It seems to me, however, a matter for regret that Dr. Minot, through inadvertence, I feel sure, should have made so sweeping and indiscriminate a condemnation of all American microscopes. I think that he must have been unaware of the excellent instruments which have been furnished of late from the workshop of J. Grunow in New York.

The useless and positively objectionable features which Dr. Minot so justly attributes to the American microscope in general, are absent from these new forms of stand, while the requirements which he so admirably summarizes are just those which Mr. Grunow has succeeded in covering.

A firm base; low, large solid stage, with simple clips for the slide; excellent brass-work; with or without knee, nose-piece, and rack and pinion, coarse adjustment, Abbé condenser, as the purchaser may desire; and optical qualities in the lenses which bring them strictly within the category of first-class, — these are the qualities which the new Grunow instruments present. Forty of these microscopes have recently been added to the supply of the laboratory of the Alumni Association of the College of Physicians and Surgeons, New York, after a full personal examination of instruments supplied by the more prominent continental makers.

I feel greatly indebted to Dr. Minot for clearly indicating, as only an accomplished microscopist like himself could, the direction in which American microscope-makers should work, and I am certain that he will learn with pleasure that by one American maker at least, his requirements are being scrupulously met.

T. MITCHELL PRUDDEN.

New York, Dec. 12.

THE issue of *Science* of Dec. 2 contained an article which is so sweeping in its denunciation "of any microscopes whatsoever of American manufacture," and its commendation of the German or French instruments, and places the motives of American manufacturers in such questionable light, that as one of them, and especially in consideration of circumstances hereinafter mentioned, I consider it proper to say something in answer.

The objections in the article can be enumerated as follows: —

1. "The fundamental error in microscopes of American manufacture is that they are for the most part constructed with a view of, I might almost say, entrapping inexperienced purchasers. The zeal of the maker is turned too much to decorative lacquering and nickel-plating; he adds to his stands as great a variety of mechanical contrivances and adjustments as the price of the stand will permit, and many of these contrivances are not really commendable for their utility."

The supply of a product is created and controlled by the demand for it. As the microscope is an instrument for scientific research, it is used by a class of people of more than ordinary intelligence; and, as most of the instruments purchased pass through the hands of persons of wide experience, they are fully capable of determining what is best suited to their wants, and will certainly not permit the maker to prescribe what they should take. The American instruments as constructed to-day are almost generally a combination of improvements, such as have suggested themselves to the practical mind of the advanced American worker, and which have been adopted and carried out by the maker; and this co-operation between worker and maker has long been a matter of congratulation. That the majority of American innovations are real improvements is shown by the fact that the need of them is felt abroad, and that many of them are being gradually embodied into foreign instruments. That the American maker "adds to his stands as great a variety of mechanical contrivances and adjustments as the price will permit," is certainly not to his discredit, neither is the fact that he endeavors to make the outward appearance of his instruments conform to that of its general workmanship.

2. "In the majority of cases the stands are made to tilt, which, for one that uses the microscope for real work, is an almost useless luxury."

Whether an instrument shall be used in an upright or inclined position depends upon the requirements of the worker. It is true that "in the majority of cases the stands are made to tilt;" but as this feature adds, not a considerable, but, on the contrary, a very trifling expense, there is no reason why it should not be used continually in an upright position if so desired; and it gives the additional advantage that it may be inclined, and there is no doubt that much real work is accomplished when it is in this position. However, instruments without the joint are catalogued by some makers, and may be had by those who desire them; but the fact that the maximum ratio of instruments without joint, as against those with them, is as 1 to 100, is sufficient evidence of the desirability and inexpensiveness of the hinge.

3. "This same fact . . . renders it indispensable that the microscope should not be too high, . . . so that we must put down the ten-inch tube as a bad feature for a student's microscope."

To the best of my knowledge, *all* American makers provide draw-tubes to their smaller instruments, by means of which they may be contracted to as great an extent as any of the foreign ones, and in my opinion the ten-inch tube is most decidedly not an undesirable feature. For a long time many of the best microscopists of this country, as well as of Europe, have complained of the want of unanimity among manufacturers in the construction of those parts which are absolutely necessary in the microscope. Thus the size of screw in objectives is probably definitely settled in favor of the English standard, as this is almost universally accepted; and when not, it is by a few German and French makers. The length of tube has for many years been the subject of agitation, and the tendency is slowly but surely in favor of the ten-inch standard, and by far the largest proportion of instruments are now constructed accordingly.

4. "The stage of the American microscope is very faulty."

The stage of the American microscope does not differ materially rom the majority of foreign ones. In almost all of the cheaper forms it is "large and flat, with nothing upon it except a pair of spring clips and a hole for a diaphragm." I am quite sure that it is not only the amateur or fancy collector who uses the supplementary glass stage; and as to the mechanical stage, I think that this originated in Europe, and is used even more there than in this country.

5. "Then the Iris diaphragm is often introduced to allure the inexperienced, but it is not a good form except in conjunction with an achromatic condenser."

The apparatus is a European invention: it is widely used, and highly valued by many persons. No doubt many would be pleased to know what optical or mechanical reason exists, which prevents it from being a good form. Besides this, the honesty of the American manufacturer will not permit him to stoop to any subterfuge whatsoever to allure a purchaser; and the application of the Iris diaphragm to an instrument can in no manner be construed to be such, especially as the purchaser may select the diaphragm of his preference.

6. "There are other details of construction which are equally open to unfavorable criticism, but it is unnecessary to go into their discussion." If there are any other points, it seems but proper that they should be stated.

7. "The eye-pieces and objectives are generally, though not always, of a decidedly inferior character: when they are really good, the lenses are very expensive."

This statement is a condemnation of American optical work, which, with a knowledge of the literature on the subject, and acquaintance of work which has been and is to-day produced, simply cannot be made. Many of the important improvements have been inaugurated by American opticians, and their work has been of a high character, — a fact which is willingly conceded by a large number of European microscopists who are fully qualified to judge. That they have not retrograded is evinced by what they are doing at the present day. Taken as a whole, I believe it can be safely claimed that American objectives are of a higher grade, and more uniform, than the European. More than this, the prices, comparing quality for quality, are to-day fully as low as, and have been the means of lowering, the prices of those which have been brought to this country. The quality and prices of objectives, more than any other part of the microscope, are less liable to conjecture and difference of opinion, from the fact that they can be determined by actual comparison.

8. "Many valuable members of the nation are sacrificed by being obliged to pay for the advantage of a small number of men who have never shown themselves willing to supply to those by whose sacrifices they benefit, the kind of instruments wanted. . . . Is it unreasonable to ask manufacturers of microscopes in this country to furnish us instruments of the kind we really need, as some sort of acknowledgment of the money they extract from us whether we will or not?"

This complaint is not borne out by facts. As already stated, there are, among all the manufacturers of microscopes, none more progressive than the Americans. They have ever been ready to accept suggestions and to make improvements when occasion to do so presented itself. They are of sufficient business sagacity to undertake to make whatever may be called for, when there is a prospect of a reasonable remuneration for the outlay. I hope I may be excused in mentioning my personal experience in this connection.

Some years ago it came to the notice of the firm of which I am a member, that there was at a certain quarter a decided opposition to American instruments, and an influence exerted on students in favor of certain foreign ones.

To find the cause thereof, I made a special trip to Boston, and, visiting a number of gentlemen, learned that the reason of their preference was the pattern of the European instruments. Among the gentlemen consulted was the writer of the article in *Science*. I expressed a willingness to undertake to make an instrument which should meet his views, and, after receiving a general outline of his preference, returned home and began to construct an instrument in accordance therewith.

After the completion of this, I made it the object of a second visit. The instrument was thoroughly inspected and criticised, and a number of minor changes recommended, which, upon my return home, were strictly carried out. The instrument was again sent for examination, April 23, 1884, accompanied by a letter, from which the following extracts are made: —

"As you will see, we have adopted the suggestions as made by you and Prof. ———, and believe that they add considerably to the value of the instrument. . . . We send the instrument for examination, and hope you will make it severe; for we are anxious to make just such an instrument, which you consider best suited to students' use, and are convinced that we are able to do it."

Later, in reply to an inquiry about his opinion of the instrument, we received the following: —

"We have examined the Harvard microscope, and find it to be very excellent in many respects, and the objectives good."

(Signed) CHARLES S. MINOT.

During my visits I was kindly treated, received every reasonable encouragement and the promise of support in the undertaking, and was therefore the more surprised to read such charges.

If European instruments are now happily gaining supremacy, it must be of exceedingly recent date. Many scientists of this country 'happily' manifest great interest and pride in home productions; and as the American manufacturers undoubtedly will endeavor to combine in their instruments efficiency with high standard of workmanship, as they are perfectly willing to make whatever may be required, and as they will ever welcome improvements by whomsoever suggested, there seems no reasonable doubt that the 'supremacy' will be in future, as it is now, on the American side.

EDWARD BAUSCH.

New York, Dec. 13.

DR. C. S. MINOT, the able histologist of Harvard Medical School, has, in a late number of this journal, given expression very freely to his views in regard to the respective merits of microscopes of foreign and domestic make. While the present writer cannot agree in detail with Dr. Minot's conclusions, many of the points made against American instruments are, unfortunately, justified more or less completely by the facts, and by the experience of teachers and pupils in biological schools throughout the country, but similar charges can be aimed with just as much truth and equal force against many of the instruments which are imported from abroad and commended as laboratory instruments. There are many of them that I would absolutely not take as a gift if I could get the best instruments of American make, and the best of those made abroad are open to objections when considered merely as tools for general biological work. A microscope is, or ought to be, an instrument of precision, and as such it is a tool which, according as it is well or poorly made, will work satisfactorily or unsatisfactorily in the hands of the skilled manipulator. I hold that nothing is too good as a tool for either pupil or teacher in biology. Histological research and technique have reached that degree of development and perfection within the past fifteen years, that the man who was a master in histology that long since, if he were to return to the work in one of the many recently founded biological laboratories in the United States, would find that in cytology both

pupils and teachers were speaking a language which he could scarcely understand. He would also find that it was a common thing for a teacher to demonstrate to his pupils with actual specimens, day after day, things which in his own day it was utterly impossible to demonstrate except by the most laborious and roundabout methods, and which at best gave unsatisfactory results. With this enormous advance in technique or in the processes of research, has arisen a demand for a better class of laboratory instruments, which, while they are compact, simple, and of moderate height and weight, are constructed with a view to durability, and at the same time admit of use for all the ordinary purposes of the investigator or student. Such instruments should possess such qualities as would enable one to use them for the most elementary as well as for the most advanced work requiring the highest grade of manipulative skill. The senseless catering of makers to the lovers of 'brazen elephantiasis' (as I once heard an eminent histologist express himself), with their large and costly instruments, has wrought a kind of mischief which teachers have every now and then to contend against, in the tendency of poorly informed tyros buying at large cost these brazen giants, which they soon find are not what they want.

My own deliberate conviction is, that the ideal microscope for the student and investigator still remains to be devised; that neither Europe nor America has yet produced it; and that any attempt to produce such an instrument, without considering every possible and reasonable demand that can ever be made of it as a table microscope, must end in failure. Looking over the vast amount of rubbish which is constantly being figured in microscopical journals as something new and valuable, one is often tempted to make the comment, "Why could not that person have been more usefully employed than in devising that perfectly useless piece of apparatus?" There are, however, many exceptions; and I do not mean to be understood as scoffing at all new pieces of apparatus, because many of them first devised within the last ten years have been of the greatest value.

How is this ideal microscope to be realized? Who will design it, and who make it after it is designed? I would suggest that every piece be made to a standard gauge, and that thus, if any parts are broken or worn out, they may be replaced with a minimum of trouble. I would advise that the existing rack and pinion be replaced by a better construction, as no rack and pinion yet made is so constructed as to remain firm and steady after prolonged use of the instrument. The fine adjustment can be made a part of the coarse adjustment, provided the cogs of the rack and pinion are accurately cut; and this adjustment can be placed at the back of the instrument, near the fingers of the manipulator. In this way a source of weakness in the construction of both American and foreign instruments may be avoided. The outside tube in which the optical tube slides must be fixed, and form a part of its support. The optical tube must be short; tube length, with draw-tube out, not over 155 millimetres, so as not to make the instrument uncomfortably high when the tube is vertical. The support for the tube must be in a single, solid piece, which may also support the simple, flat, wide stage covered with a thin piece of hard rubber firmly fastened to its upper surface. The stage clips must be so placed that they do not interfere with moving the slide over the whole width of the stage. The base or tripod upon which the whole rests must be cast in a single piece, and the joint at the back, between the base and the supporting piece for the tube, to be made simple and strong, and so that it may be quickly tightened by the manipulator if it should get loose. This joint for tilting I hold to be necessary for certain kinds of work and for photography. The mirror bar must be large and strong, and made as nearly concentric with the surface of the stage as possible. The attachment for the condenser should be made so that it is firm, and so that the condenser is easily swung into and out of position, and rapidly adjusted up or down with as little accessory mechanism as possible. A condenser of the Abbé type is of course the only one to be considered for general work, and it should be as short as possible, so as to make it possible to keep the stage as low down or near the table as is consistent with ready and successful illumination. The concave mirror should be larger than on the most of the laboratory microscopes used here and abroad.

Now a word as to the camera lucida. This absolutely necessary piece of apparatus must be adjustable to every eye-piece, and it should be available for use with the tube upright, inclined, or horizontal, without the addition of any desks or drawing-boards to the outfit of the microscope. If the rack and pinion is properly constructed, and an adjustable or sliding collar with the Royal Society screw fitted into the optical tube or body, with this camera, and a proper combination of eye-pieces and long or short focus objectives, drawings of objects may be made, ranging from 5 to 1,500 diameters, without difficulty, and the use of an embryograph largely if not entirely dispensed with. Searcher eye-pieces might be added to the combination, which would make the outfit still more complete and varied for the use of the investigator who needs to make figures of the subjects which he studies.

It will thus be seen that the prime requisites in the microscope for the investigator are simplicity and mechanically correct construction. No instrument yet made fulfils in the largest possible measure these requirements. Mr. Zentmayer has really added important improvements to the instruments constructed in this country; and for solidity and fewness of pieces, his work (which has always been honest) has been among the very best. American observers of world-wide reputation have used American instruments and objectives with success. Among these may be mentioned men no less famous than Profs. H. James Clark, Alpheus Hyatt, and Joseph Leidy, while Prof. J. F. Rothrock's studies with American lenses upon the strength of wood as illustrated by sections has started a most important line of practical inquiry.

But notwithstanding this, as stated at the beginning, the ideal microscope is still to be placed upon the market. To have the matter assume the importance which it demands, I would suggest that the American Society of Naturalists, at their next meeting, take into consideration the question of securing a satisfactory design for a standard instrument. Let this be done by offering a prize to be competed for, and let us for once have something like uniformity of pattern in this most important instrument of research. The teacher would then have no difficulty in suggesting to his pupils what make of microscope they should buy, and every maker would not be offering instruments departing more or less from a recognized standard.

And finally, as suggested by Dr. W. P. Wilson, now that the surplus from revenue and tariff is stirring the political wiseacres at Washington, where a plethoric treasury is threatening the financial prosperity of the country, let our universities and colleges make an appeal to members of Congress, in co-operation with the American Society of Naturalists, to have the absurd tariff on imported scientific books and apparatus removed. This senseless tax on knowledge, which it seems is to be catalogued among the 'luxuries,' is a glaring and shameful disgrace to American institutions. As it is, neither American publishers nor manufacturers are profiting to any extent from this absurd regulation, nor are they likely to, even after the duties are removed. JOHN A. RYDER.

University of Pennsylvania, Dec. 15.

Sound-Blindness.

IN *Science* for Nov. 18, p. 244, I observe some remarks on certain phenomena of defective hearing, which, from their supposed analogy to color-blindness, is called 'sound-blindness.' I am very much interested in the facts, but the name I do not at all like. It seems to me very misleading. But neither is the term 'sound-deafness,' which was proposed as a possible substitute, any better. Comparing the eye and the ear, 'sound-deafness' corresponds with 'light-blindness;' but these terms express simply blindness and deafness without qualification. The correspondent of *color*-blindness is not *sound*-deafness, but *pitch*-deafness. But the phenomenon spoken of in the article referred to is neither *sound*-deafness nor *pitch*-deafness; for the characteristic of vowel-sounds is not musical pitch, but *timbre*. In so far as the phenomenon is physiological at all, the defect is therefore *timbre*-deafness. But it seems to me that the defect is probably, largely at least, a defect of perception, and not of sensation, and therefore psychological, not physiological. JOSEPH LECONTE.

Berkeley, Cal., Dec. 9.